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EXPERIMENTA ET MELETEMATA DE PLANTARUM GENERATIONE.

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EXPERIMENTS AND CONSIDERATIONS ON THE GENERATION *of* PLANTS.

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THE following Eſſay in *Latin* was publiſhed at *Leyden* in 1739: It is now tranſlated and reprinted here, that the Sentiments contained in it may be ſubmitted to more general Conſideration. Our Author's Addreſs in chooſing and conducting Experiments, and his Capacity for the abſtruſeſt Reſearches, would doubtleſs have enabled him to have given the World ample Satisfaction on this intricate Subject, had he been permitted to proſecute his Inquiries.

But

But his Country called him to more important Affairs, and kept him conſtantly engaged in Employments more immediately beneficial to Society.

The Tranſlator has endeavoured keep cloſe to his Author's Senſe: In point of Expreſſion, he fears, he often falls ſhort of the Original, the Style whereof is nervous, conciſe, and truly *Roman.* The *Latin* botanical Terms are moſtly retain'd; as we have not yet Words in our own Tongue ſufficiently claſſical whereby to expreſs the various Parts of Plants and Flowers, which the growing Science is obliged to deſcribe; and to explain by Terms adopted from other Languages.

It is hoped this little Eſſay will be received with the Candour due to thoſe who endeavour to pleaſe and inſtruct; if the Tranſlator has failed in promoting theſe Ends, he can only plead his Intention to the contrary, and requeſt the Indulgence both of the Public and his Author.

J. F.

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DE

PLANTARUM GENERATIONE

Experimenta *et* Meletemata.

CUM de generatione tum ſtirpium, tum animalium, olim mihi variæ ſuborirentur dubitationes, quamprimum de farina fœcundante, ſeu ſemine maſculino inaudiveram, ſpes mihi haud mediocris affulſit, lucis aliquid rei adeo obſcuræ inde affundi poſſe. Et cum jampridem vix citra ſtuporem creſcendi modum in planta *Americana*, quæ frumentum *Indicum*, ſeu *Maiz* nuncupatur, obſervâſſem, hanc omnium quas noveram, vel forte quas educat natura, experimentis capiendo maxime idoneam cenſebam.

EXPERIMENTS *and* REFLECTIONS ON THE GENERATION *of* PLANTS.

AS ſeveral Doubts had formerly occurr'd to me in reſpect to the Generation both of Plants and Animals, when I firſt heard of the *Farina fœcundans*, or impregnating male Duſt, I conceived great Hopes that theſe would be eaſily ſolved, and the Whole of this intricate Affair receive conſiderable Light from the Diſcovery. And as I had long ago obſerved, with Surprize, the ſingular Way of Growth of our *Indian* Wheat or Maize, I judged it, of all the Plants I had ſeen, or perhaps of any that Nature produces, the moſt proper one for Experiments of this kind.

Ad proceritatem enim ſex, octo, quandoque decem pedum evehitur: in culmi vertice ſtamineum fert cirrum, ſeu (uti vocat *Malpighius*) muſcarium apicibus inſtructum, e quibus evolvitur farina; ſubtus ex caulis geniculis ſpicas protrudit, ſex, octo, decem, vel etiam duodecim pollices longas. Spica ex ſcapo interraneo bene ſolido, et pollicem circiter craſſo conſtat, cui adnaſcuntur pulcherrimi granorum ordines, plerumque octo, ſæpe autem decem, rarius vero duodecim; ſed etiam ſedecim vidi. In quovis ordine ſunt ſeminis grana plus minus quadraginta, quæ in formationis primordiis, cum adhuc tenella eſt ſpica, ova jure dici poſſent: cuique autem ovo adnaſcitur filum album, læve, tenue, et, præterquam quod ſit cavum, fili ſericei inſtar: hæc ſingula fila inter ordines ſeriatim a prima ad extremitatem ulteriorem perreptant, ubi ex diſcludentibus ſe foliis, quæ ſpicam totam muniunt in faſciculo ſeu ſchœno, ſe aëri

Indian Wheat grows to the Height of 6, 8, and ſometimes 10 Feet. At the Top of the Stalk it bears a thready Tuft or Taſſel (called by *Malpighi Muſcarium*) furniſh'd with *Apices*, which yield the *Farina.* From the Joints of the Stalk below, the Ears grow out, which are 6, 8, 10, and ſometimes even 12 Inches long. Theſe conſiſt of a pretty ſolid Subſtance, about an Inch thick, ſet quite round with Grains regularly diſpoſed in Rows, in a very beautiful Manner. Generally there are eight ſuch Rows, often ten, ſometimes twelve; and I once ſaw ſixteen: There are commonly forty Grains in each Row, more or leſs; which, in their firſt Rudiments, and whilſt the Stalk they grow upon is ſoft and tender, may juſtly be called the *Ova* or Eggs: To each *Ovum* there adheres a white, fine, ſmooth Filament, which, excepting that it is hollow, reſembles a Thread of Silk. Theſe Filaments are diſpoſed one by one in Order, betwixt the Rows from that End where the Ear riſes from the Stalk to the other, where they creep from under the Caſe that incloſes the Ear, and make their Appearance,

ſiſtunt prominentia, colore ſæpius, in hac parte prominente, albicantia, quandoque vero pro varia plantæ ſpecie, flaventia, rubentia, aut purpuraſcentia; atque hæc fila, ut ſuſpicabar, veros ovorum ſtylos eſſe poſtmodum deprehendi.

In hac planta igitur experimenta capturus, in hortuli mei urbani quadraginta pedes lati, et octoginta circiter longi ſingulis angulis, colliculis pro ſationis more aggeſtis, menſe *Aprili* inclinante, ſeminis grana quaterna aut quina commiſi. Inchoante autem *Auguſto*, cum planta ad juſtam magnitudinem jam increviſſent, et cirri in vertice, ſpicæ ad caulem ſe plene extuliſſent; ex uno colliculo totos hos cirros penitus demeſſui; in alio autem intactis cirris, ab aliis ſpicis leniſſime diſcluſis eas obtegentibus foliis, et denuo concluſis, totum filorum, ſeu ſtylorum faſciculum abſcidi; ex aliis tantum unam, ex aliis binas, ex aliis ternas partes, quartas, reliquis integris relictis: aliam vero ſpicam, priuſquam ſe luci ſiſteret faſciculus, linteo

in the open Air, in a Bundle or Skein: Their Colour in this Part is moſtly whitiſh, though ſometimes a little yellow, red, or purple, according to the Nature of the Plant they grow from: Theſe Filaments, as I formerly ſuſpected, are the real Styles of the Eggs.

Intending therefore to make ſome Experiments on this Plant, towards the End of *April*, I planted four or five Grains on Hillocks, as is uſual in ſowing Maize, in each Corner of a little Garden I had in Town, which was about 40 Feet wide, and 80 long. About the Beginning of *Auguſt*, when the Plants were full-grown, and the Tufts on the Top, and the Ears on the Stem, had acquir'd their full Extent, I cut off theſe Tufts from every Plant on one Hillock. On another, without meddling with the Tufts, I gently open'd the Leaves that cover'd the Ears, and cut away from ſome all the Styles, and then cloſed the Leaves again; from others a Quarter Part, from others one Half, and from others three Quarters, and left the reſt untouched. I cover'd another Ear, before the Skein of Styles appear'd out of the Caſe

linteo *Indico* ſeu *Sinenſi*, tenui et lanuginoſo (*Muſlin*) leviſſime obvolvi, ita vero laxe, ut vegetationi ne minimæ eſſet fraudi, quin propter lintei tenuitatem ſolis, aëris, et imbrium beneficio ſpica frueretur, nullus vero propter lanuginem pateret farinæ aditus. Quarti colliculi plantas integras et intactas, ut et aliarum quamque in eo quem dixi ſtatu ad maturationis tempeſtatem permiſi.

Adventante igitur *Octobri* menſe, cum in operationum harum eventum inquirendi afforet tempus, hæc mihi comperta ſunt. In primo colliculo, ubi omnes decollaveram cirros, licet ſpicæ ſpeciem ſatis commodam conſpectui exhiberent, involucris ſuis utpote (ut ſemper) obtectæ, tactui tamen graciles et leves, ne vel unicum perfectum granum reperi, præterquam in una ſpica grandiore, quæ e caule ſuo protenſius eminens, adverſus colliculum proximum (ex qua parte apud nos vehementiores ſpirare ſolent venti) proſpectabat; in iſta enim unica ſpica viginti præterpropter ad juſtam molem et perfectionem ematuruerant, granulorum farinæ ope, ut conjiciebam,

vento

with a Piece of very fine and ſoft Muſlin, but ſo looſely, that its Growth could not be injur'd; and whilſt the furzy Texture of the Muſlin ſuffer'd it to receive all the Benefit of the Sun, Air, and Showers, the *Farina* was effectually ſecluded. I left the Plants on the fourth Hillock, as I did theſe, except in the Circumſtances above-mentioned, unmoleſted, till they were fully ripe.

About the Beginning of *October*, when it was Time to inquire into the Succeſs of my Experiments, I made the following Obſervations. In the firſt Hillock, where I had cut off all the Tufts, the Ears, whilſt they remained covered with their Husks, look'd indeed very well, but were ſmall, and felt light when handled; and not one perfect Grain to be found in them, except in one large Ear, which grew out ſomewhat farther from the Stalk than uſual, and on that Side too which faced another Hillock in a Quarter from whence our ſtrongeſt Winds moſt commonly blow: In this Ear alone I found about twenty Grains which were full-grown and ripe. I attributed this to ſome *Farina* brought

vento iſthuc aliunde delatorum. In iis quibus evulſeram ſtylos, totidem ad unum reperta ſunt ſemina, quot reliqueram intactos ſtylos; in iis quas linteo obvinxeram, ne vel unicum; in ovis irritis ſeu caſſis, nihil præter pelliculam ſubaridam conſpiciebatur.

Ex his experimentis a me ſumma cum accuratione inſtitutis et patratis, ut et ex aliorum plurimis, farinam hanc ex apicibus evolutam verum ſemen eſſe maſculinam, et fæcundationi uteri et ſeminum omnino neceſſariam liquidiſſime conſtat; quod tamen omnia ſecula uſque ad noſtrum latebat. Dignus jure merito eſt igitur hujus naturæ arcani inventor, cujus perpetua celebretur memoria. Is autem fuiſſe videtur *Thomas Millington*, eques auratus *Anglus*, profeſſor ſuo tempore *Savilianus*, ante vel circiter annum 1676. ita enim retulit *Grævius* (*Nehemiah Grew*, M.D.) in lectione coram *Societate Regia*, nono *Novembris* iſtius anni habita. (Vide *Grævii* opera, *p.* 161, et 171.) *Malpighius* quidem, quantum novi,

by the Wind from a diſtant Plant. In thoſe Ears from which I had plucked off ſome of the Styles, I found juſt ſo many ripe Grains as I had left Styles untouched. In thoſe covered with Muſlin, not one ripe Grain was to be ſeen: The empty or barren Eggs were nothing but mere dry Husks.

From theſe Experiments, which I made with the utmoſt Care and Circumſpection, as well as from thoſe made by a great many other Perſons, it is very plain, that this *Farina*, emitted from the Summits of the Styles, is the true Male Seed, and abſolutely neceſſary to render the *Uterus* and Grain fertile. A Truth which, however certain, yet was unknown till the preſent Age: The Diſcoverer of this grand Secret of Nature ought ever to be remember'd with due Applauſe. Sir *Thomas Millington*, ſometime *Savilian* Profeſſor, ſeems firſt to have taken notice of it, before or about the Year 1676. according to the Account which Dr. *Grew* gave, in a Lecture read before the *Royal Society* the 9th of *November* the ſame Year. (*See* Grew's *Works, p.* 161, 171.) *Malpighi*

nuſquam illius uſus meminit; ipſe autem *Græviu*s ad fœcundationem neceſſariam eſſe farinam, non autem uterum ingredi ſuſpicatus eſt: at viginti aut plus eo poſt annos, *Samuel Morlandus*, itidem *Anglus*, in ipſum uterum per ſtyli canaliculos delabi aſſeruit. (Vide *Acta Philoſ. Angl.* num. 287.) Ego quidem ſemel in medio unius ex ſupra memoratis ſtylis frumenti *Indici* granulum conſpexi; nec dubitandum reor, quin exquiſitiore adhibita diligentia, in iis delabentia facile deprehendantur. Hactenus autem dicta jam ſatis ſunt vulgata, et harum rerum curioſo nemini non nota; quæ vero ſequuntur obſervata eorum meditatione qui naturæ indagandæ incumbunt, non indigna fortaſſe comperientur. Poſt hæc capta experimenta, mihi neque per valetudinem, nec per negotia, his diſquiſitionibus vacare fere licuit: quoad vero licuit iſta præcipue notanda mihi videbantur.

Non tantum in hac planta, in arboribus nuciferis, arundinibus, cucurbitis cum tota earum familia, ſcilicet, pepone, melone, cucu-

no-where, that I know of, mentions its Uſe. And *Grew* himſelf, tho' he allows it neceſſary for Fecundation, yet did not ſuſpect, that it enter'd the *Uterus*: But *S. Morland*, about twenty Years after, aſſerted, that it enter'd the *Uterus* thro' the Canal of the Style. (*See* Phil. Tranſ. N°. 287.) I once ſaw a ſmall Grain in the Middle of this Canal; nor is it to be doubted, but that ſtricter Inquiries will diſcover more of them paſſing the ſame Way.

It is true, that what has thus far been ſaid is now very well known to every one, who is in the leaſt acquainted with theſe Matters; but the Obſervations that follow may not perhaps be unworthy the Attention of the Curious. Want of Health, and ſufficient Leiſure, after I had made theſe Experiments, prevented me from proſecuting them any farther; but, as theſe permitted, I put down the following Remarks.

Not only in this Plant, in Nut-bearing Trees, Reeds, in all the Tribe of Gourds, as Pompions, Melons, Cucumbers, *&c.* in which

mere, *&c.* in quibus omnibus diſſitas occupant ſedes hæ partes maſculæ et fœmineæ, quæ generationi inſerviunt, ſed in eorum etiam florum pleriſque, qui a quibuſdam hermaphroditæ nuncupantur, quippe quod intra idem petalorum ſeptum utraſque partes complectuntur, eo locantur ſitu apices, ut poſtquam elaborata fuerit farina, vix, et ſæpius ne vix quidem, os uteri ſeu ſtyli ſummitatem poſſint attingere: ſed in iis etiam pariter ac in longius diſſitis, neceſſe habetur, ut farina prius ex ſede ſua in apice, divulſa penitus et eliminata, libero innatet aëri undique illam ambiente, et caſum quaſi fortuitum ſubeat, num ad os uteri ſeu ſtyli unquam perveniat (quo tamen ut perveniat, atque in eo fungatur officio ſuo, ut fructum ferat planta, omnino exigitur) aut vento et imbre diſcuſſa diffletur, et prorſus diſſipetur.

Huic affinis etiam videbatur inſignis ea apparatus diſcrepantia, quem ex altera parte in compangendo et tutando utero cum ovis ſuis, et ex altera in formandis ſtaminibus, apicibus, et farina adhibitum a natura cernimus. Uterus ſeu ovarium ex ramuſculi ſeu cauliculi meditullio educitur, et

which the Male and Female Parts of Generation are ſeparately placed, but alſo in moſt of thoſe Flowers, which, from both Parts being placed within the ſame Flower-cup, are by ſome called *Hermaphrodites*, the *Apices* are ſo ſituated, that, after the *Farina* is perfected, they can ſeldom if ever, touch the Summit of the Style, or *Os Uteri*. But in theſe, as well as in ſuch where the Organs are ſeparately placed, the *Farina* muſt of Neceſſity, after it is thrown off from the *Apices*, float in the circumambient Air, and be ſubjected to the Hazard of not reaching the *Os Uteri*, and performing its Office there (tho' this is abſolutely requiſite for Fructification); but is left to the Mercy of the Wind and Rains, and may be wholly loſt.

Of the ſame Nature appears to be the remarkable Difference obſervable in the *Apparatus* which Nature makes uſe of in forming and defending the *Uterus* and its Eggs on one Hand, and in providing the Chives, the *Apices*, and *Farina*, on the other. The *Uterus* or *Ovarium* is produced from the Heart of the little Branch

et pro plantæ indole validiſſime undique munitur, cum ipſa tamen ova ſua uſquedum a ſemine maſculino fœcundentur, ex ſola pellicula liquore homogeneo repleta conſtare videantur: at vero ſtamina huic ſemini fœcundanti ferendo diſtincta, vel tantum ex deciduis florum petalis, tanquam ex cute pili, vel una cum iis ab eadem origine enaſcuntur: quod videre eſt in iis etiam floribus, quorum ſtyli, ut in malvis, *&c.* theca aut vagina ſtaminea muniri conſpiciuntur; quæ duo, ſcilicet ſtylus et vagina, licet rem unicam conficere videantur, omnino tamen diſpar eſt partium origo: ſtylus enim, ut in omnibus, e medio exſurgit ovario, vagina vero petalis, utpote ex iiſdem fibris oriundis adhæret. Apices autem ex pelliculis pulpa quadam, ut videtur, parenchyma et homogenea refertis conſtant, quæ tamen pulpa, dum adhuc mollis et uvida, in granula ſua dividi comperitur.

Horum

or Stalk it grows on, and is on all Sides ſtrongly ſecured, according to the Nature of the Plant; excepting in a few of thoſe Plants called *Gymnoſpermæ*. At the ſame time the Eggs, till they are render'd fruitful by the Male Duſt, ſeem only to conſiſt of a thin Pellicle full of an homogeneous Liquid: Whilſt the Chives, deſigned to bear this impregnating Subſtance, grow either out of the *Petala*, which ſoon fall off like Hairs from the Skin, or from the Parts whence the *Petala* ſpring; as may be obſerved in thoſe Flowers whoſe Styles are protected by a Caſe or ſtaminous Sheath, as in Mallows, *&c.* Which two, *viz.* the Style and its Sheath, tho' they ſeem to compoſe only one Body, yet ariſe from very different Parts. For the Style in every Plant grows from the Middle of the Ovary; but the *Vagina* adheres to the *Petala*, being formed of Fibres detached from the ſame Origin with them. The *Apices* or Summits conſiſt of Pellicles, filled, as it appears, with a kind of homogeneous Pulp or *Parenchyma*; which, neverthleſs, whilſt it is ſoft and moiſt, may be obſerved to conſiſt of little Grains. As

Horum apicum paulatim ſicceſcentium tunicis, quæ ſunt tenuiſſimæ, diſruptis evolvitur farina, quæ ita tunicis adhæret, ut primo vix ulla concuſſione a ſede ſua dimoveatur : at cum apices ex tenui iſto filo penduli in aëre motitentur, ſenſim ſponte defluit, et floris variis partibus, præcipue autem ſtyli ſummitati, quæ liquore viſcoſo aut lento inſtruitur (terebinthinam vocat *Malpighius*) tanquam pulviſculus temere inſperſus adhæret. Sin autem per aliquot dies ſerenos nulla ſpiret aura quæ apices moveat, ex caulis frumenti *Indici* concuſſione, in altum ſe feret pulvis, nebulæ aut fumi inſtar. Hoc etiam in hac planta notari meretur, quod quo die diſrumpuntur apices, et pendulos ſe produnt in aëre, eodem die cernuntur congeriei ſeu faſciculi ſtylorum extremitates, ex ſpicæ integumentis ſe in aëra protrudentes, quod in aliis etiam obſervandi anſam merito præbere poſſit.

the thin Coats of theſe *Apices* by degrees become dry, they burſt, and the *Farina* is turn'd out; which at firſt ſticks ſo faſt to theſe Coats, that it cannot be eaſily ſhaken off; but, as the *Apices* hang looſely by a very ſlender Thread, and are conſtantly moved by the Air, the *Farina* gradually falls off, and ſticks like Duſt to various Parts of the Flowers, but eſpecially to the Tops of the Styles, which are furniſhed with a viſcid clammy Liquor, called by *Malpighi*, *a Turpentine*. But if it happens, that, for a few Days, there is not Wind enough to ſtir the *Apices*, if one ſhakes the Stalk of the Maize, a large Quantity of the *Farina* flies up like a Cloud of Smoke or Duſt. There is likewiſe farther to be obſerved in the Maize, that, on the ſame Day when the *Apices* burſt, and hang looſely waving in the Air, the Skein or Bundle of Styles appear from under the Husk or Sheath that covers the Ear, and are in like manner exposed. This Circumſtance ſhould put us upon obſerving what happens in this Reſpect to other Plants.

Farinæ hujus granula in eadem plantæ ſpecie ſunt omnino uniformia; at in diverſis diverſam obtinent figuram. In plurimis ſunt teretia ſeu globoſa, in multis oblonga tritici inſtar, in quibuſdam, veluti caltha, malvis, et aliis, rotam dentatam ſeu globulum aculeis obſitum repræſentant. Angularia nunquam vidi, qualia tamen inter alias formas exhibet *Grævius* in viola tricolore. (*Anatome*, TAB. 58.) Sed plerumque ſunt lævia; et nitentia in frumento *Indico* compreſſa videntur.

Sed in ipſa ſeminis generatione ſeu incrementi ſui proceſſu, uti eum enarrarunt et depinxerunt celeberrimi illi plantarum anatomici, quod etiam partim ex autopſia eſt mihi comprobatum, ſunt quæ in admirationem plane rapiant, et quæ meditatione penitiore jure digna videantur.

Primo enim cum defluente omni floris ſatellitio, et emarceſcentibus ſtylis, intumeſcere cœperit ovum, in ejus ſummo prodit ſe veſicula, quam amnion appellat *Malpighius*, umbilicali inſtructa per

The Particles of the *Farina* have all the ſame Figure in the ſame Species of Plants; but are different in different Species. In moſt Plants they are round or globular; in many they are oblong, like Grains of Wheat; in ſome, as the Marigold, Mallow, and others, they appear like an indented Wheel, or as a Globule ſet round with Prickles. I never ſaw any angular ones, as *Grew* deſcribes in the Panſy (*Anatom.* TAB. 58.); for the moſt part they are ſmooth and ſhining; in the Maize they ſeem flat.

But in the Generation of the Seed itſelf, and the Proceſs of its Growth, as deſcribed by *Malpighi* and *Grew*, and which I have likewiſe obſerved, there are ſeveral Things which create Aſtoniſhment, and juſtly claim our ſerious Conſideration.

In the firſt place, when all the gay Pomp of the Flower fades, the Styles drop off, and the Egg begins to ſwell, a little Bladder, which *Malpighi* calls the *Amnion*, appears at its Point; this is furniſhed with an umbilical Cord, which paſſes thro' the *Chorion*

chorion in adverſam ovi partem producto. Augeſcente vero cum ovo amnio, poſt aliquot dies in hujus vertice alterum quiddam minutulum conſpicitur, quod itidem indies increſcit, uſquedum totum amnion, ut et hoc totum chorion, ovumque totum compleat; his duobus (amnio et chorio) in putamina aut ſeminis tunicas cedentibus: et hoc jam ad juſtam ſuam molem auctum et maturatum pro vero ſemine habetur, quod intra putamen et tunicas plerumque in binos, rarius in plures lobos diſpeſcitur, quandoque vero in nullos, ut in frumentis, in quibus nulla eſt hujuſmodi diviſio.

Sed in hoc proceſſu, præ cæteris hoc notandum occurrit, nempe quod dum increſcit ſemen, in apice ejus, ut in arboribus nuciferis, pomiferis, et aliis; in quibuſdam vero ad latus, aliud ſe prodit minutius quiddam, quod primo tanquam granulum adventitium, vix ullibi cum reliqua ſeminis mole cohærens deprehenditur: ſenſim autem tot projicit venulas quot ſunt in ſemine lobi, per quas ſe illis tenuiter annectit,

Chorion to the oppoſite Part of the Seed. The *Amnion* increaſing with the Egg after a few Days, another little Body is diſcovered, which in like manner daily increaſes, till it fills up the whole *Amnion*, as the *Amnion* does the *Chorion*, and this at length the whole Egg. Theſe two, *viz.* the *Amnion* and *Chorion*, then become the Husks or Coats of the Seed; and this, when it has acquired its full Size and Maturity, is the real Seed: when the external Husk is removed, it is found to conſiſt for the moſt part of two Lobes: Sometimes it is not divided at all, as in Bread-Corn.

In this Proceſs it is particularly to be remarked, that, whilſt the Seed is increaſing, another ſmall Body is obſerved, in ſome, at its Point, as in the nuciferous, pomiferous, and ſome other Trees; in others, at one Side; which, at firſt, looks like ſome adventitious Body, and foreign to the Seed, with which it appears to have ſcarce any Connexion. By degrees it puts out juſt ſo many little Veins as there are Lobes in the Seed: Theſe Veins connect this Body to the

et hæ per lobos diſperſæ, ut arteriæ in foliis diradiantur.

In ſeminibus quorum apici hoc inſiſtit, res plane diſtincta et a ſemine diverſa eſſe videtur: conſtat autem duabus partibus altera, quæ detractis exterioribus integumentis conſpectior prominet, a *Grævio* radicula dicitur, quod in radicem plantæ abeat; altera vero, quæ inter ſeminis lobos deliteſcit, ab eodem pluma nuncupatur; nam quod cauliculum cum foliis in ſe contineat, plumoſa videtur: utræque autem partes quodam internodio conjunguntur.

Hæc pluma in ſeminibus grandioribus, quorum lobi e terra cauli adhærentes ſurſum feruntur, et in folia evadunt ſeminalia, divulſis lobis, conſpicuam (et in phaſeolis amœno quidem ſpectaculo) ſe præbet. In fabis, et piſis, et aliis hujuſmodi quorum non exſurgunt lobi, craſſior et firmior videtur hujus cum lobis

Seed, and afterwards diſperſe themſelves through the Lobes, as the Arteries are ſpread thro' the Leaves.

In thoſe Seeds wherein this little Body is placed at their Point, it ſeems to be very diſtinct from them: It conſiſts of two Parts; one of which, when the external Teguments are taken off, appears more conſpicuous, and is called by *Grew* the *Radicle*, becauſe it forms the Root of the Plant; to the other, which lies hid betwixt the Lobes of the Seed, he gives the Name of *Plume*, becauſe, as it contains the Embryo, Stalk, and Foliage of the future Plant, it has ſomewhat of the Appearance of a Feather: Both theſe Parts are united by a kind of ſlender Joint.

In the larger Seeds, whoſe Lobes adhering to the Stalk are turned out of the Ground, and become ſeminal Leaves, this Plume is very conſpicuous; in Kidney-Beans eſpecially it is extremely beautiful. In Beans, Peaſe, and other Plants of this kind, whoſe Lobes do not riſe out of the Ground, the Connexion

nexus; at detracta ſecunda ſeminis tunica, quæ hujus eſt prima ſeu exterior, eodem modo ſe habere cernetur quo ſe habet in nuciferis aliiſque jam memoratis, extraneum nempe aliquid et inſititium a toto reliquo ſemine alienum videbitur: et hoc verum eſſe plantæ ſeminulum, ſeu potius veram plantulam, ad vegetationem in alterum annum jam conformatam et paratam conſtat. Reliqua vero tota ſeminis moles, tum animalium victui, tum alimento plantulæ idoneo ſubminiſtrando, donec firmiores in terra egerit radices, ſolummodo inſervit.

Ex hoc ſeminulo ſolo totam educi plantam, niſi quod caulis tunica exterior ex interiore ſeminis tunica quandoque conſtituitur, certiſſime liquet. Namque licet in frumentis quibuſdam, ut hordeo, avena, frumento *Indico*, radicula ex altera parte ſeminis in radicem abeat, ex adverſa vero parte emergat caulis; hic caulis veruntamen haud ſecus ac in aliis, ab eadem prodit radicula;

Connexion of the Plume with the Lobes appears more firm and compact; but when the ſecond Coat of the Seed, which is the firſt or external one of the Plume, is removed, it has juſt the ſame Appearance as in the nut-bearing and other Trees abovemention'd; that is, it looks as if it were a foreign or adventitious Body grafted upon the Seed. This in reality is the true Seed of the Plant, or rather the Plant itſelf, form'd and prepar'd for Vegetation againſt the following Seaſon; whilſt the reſt of the Seed ſerves only for the Food of Animals, and to ſupply the tender Plant with proper Nouriſhment, till it is become ſtrong enough to prepare and extract it from the Earth.

It is very certain, that the whole Plant is drawn or unfolded out of this little Seed in Miniature; ſave that, in ſome, the outer and inner Coats of the Seed give a Covering to the Stalk: For tho' in ſeveral Kinds of Corn, as Barley, Oats, and Maize, the Radicle on one Side of the Seed becomes the Root, and the Stalk ſhoots out on the oppoſite; yet this Stalk proceeds from the ſame Radicle here, as well

radicula : ab ea enim per venam ſeu canaliculum ſubcutaneum perrepit, donec ex altera parte ſe exſerat, nec in progreſſu ſuo, cum reliquo ſemine quicquam videtur habere commune.

Ita igitur inveſtigato hoc generationis proceſſu, reliquum eſt, ut quid inde veriſimillimum colligendum ſit aut aſtruendum, diſpiciamus. Primo farinam utero aut ovis fœcundandis omnino neceſſariam vidimus : huic item farinæ producendæ tenuem admodum a natura adhiberi apparatum : maturatam vero ventis et aëri, priuſquam os uteri ſeu ſtylum poſſit attingere, plerumque permitti : cui proceſſui, a perpetua naturæ in aliis lege, toto cœlo diſcrepanti, certam aliquam ſubeſſe rationem minime dubitandum eſt. Naturam enim breviſſimum et certiſſimum operandi modum affectare in omnibus conſtat: itaque in hoc negotio farinam utero ingerendi,

well as in other Plants; for it paſſes from the Radicle in the Form of a Vein, or ſubcutaneous Canal, till it ſhews itſelf on the other Side, without appearing to communicate with the reſt of the Seed.

Having thus enquired into the Proceſs of Generation, let us now conſider what Uſe may be made of our Obſervations. In the firſt place, we ſee that the *Farina* is abſolutely neceſſary for rendering the *Uterus* or *Ova* fruitful: That to produce this *Farina*, Nature only makes uſe of a very ſimple *Apparatus*; that, when perfected, it is frequently committed to the Air and Wind, before it can reach the *Os Uteri* or Style: A Proceſs, which, as it differs ſo much from the common Conduct of Nature in other Caſes, muſt doubtleſs be founded upon ſome ſubſtantial, tho' leſs obvious Reaſon. For, as it is manifeſt that Nature always makes choice of the ſhorteſt and moſt certain means to obtain her End; ſo it cannot be doubted, but that a more expeditious and compendious Method of conveying the *Farina* to the *Uterus* would have been employed,

ingerendi, ni obſtaret majoris momenti aliquid, cui aliter providendum erat, expeditiora viæ compendia inſtituram fuiſſe exiſtimandum eſt. In ovis porro, antequam a farina imprægnentur, nihil præter liquidum quoddam (ut vocat *Malpighius*) colliquamentum reperiri cernimus: in amnio novam moleculam ſe exſerere, quæ totam conſtituit ſeminis molem: in hoc ſemine denique tanquam omnino extraneum et inſititium quiddam, verum ſeminulum, ſeu veram plantulam comparere.

Jam vero ſi cum totum hunc proceſſum, tum ipſius plantæ conformationem, ex quot nempe et quam variis ea conſtet partibus, radice ſcilicet, caule, foliis, canalibus, colis, cum infinitis aliis rite perpendamus, unde etiam vel quibus modis et meatibus in hoc granulum convehi poſſint tot diverſarum partium ſtamina, et quo intercedente artificio, in ſtupendum illum ordinem quem cernimus et ornatum digerantur et compaginentur, ſedulo reputemus; vix eſt ut ex iſto ſimplici proceſſu hanc artificioſiſſimam conformationem et compaginationem plane mirabilem quovis pacto deduci poſſe exiſtimemus: non enim

ployed, had not ſomething of greater Conſequence, which was to be regarded, prevented it. Beſides, we find nothing in the *Ova* before Impregnation, except a kind of liquid Subſtance, called by *Malpighi Colliquamentum.* In the *Amnion* a new little Subſtance ſhews itſelf, and makes up the Bulk of the Seed: Laſtly, in this Seed the true ſeminal Principle, the real Plant itſelf, appears, as if it was ſomething foreign, and grafted upon the other Seed.

If then we deliberately view the Whole of this Proceſs, and conſider the Structure of the Plant itſelf, and of how many and how different Parts it conſiſts, namely, of a Root, a Stalk, Leaves, Canals, Strainers, and other Inſtruments without Number, if we likewiſe reflect, by what Means and Paſſages the Rudiments of ſo many different Parts are convey'd into this little Particle, by what Machinery they are formed and united into ſuch amazing Order and Beauty, it is ſcarcely poſſible to conceive, that ſo wonderful a Structure ſhould be the Effect of ſo ſimple a Proceſs. It not only exceeds the utmoſt

Limits

enim tantum humanum (ut pleraque) captum ſuperare, ſed rationi etiam abſonum merito poſſit videri.

Itaque cum ab omni ævo hoc generationis opificium indiſſolubilibus premi difficultatibus compertum ſit, omniaque illius explicandi molimina hactenus incaſſum ceſſerint, quidni ipſam naturam in iſto proceſſu, in eo præſertim quod ſeminulum a reliquo ſemine diſcretum ita obvium oculis noſtris ſiſtat, rem totam quaſi digito palam monſtrare cenſeamus? Farinam ſcilicet ideo aëri liberam dimitti, quo ipſiſſimum verum ſeminulum, ſeu plantulam extrinſecus in ſtaminibus ſuis minutiſſimis, et quidem ob exiguitatem aciem noſtram fugientibus omnino tamen perfectis, jam prius formatam et paratam in ſe recipiat, et hujus virtute prægnans reddita vi indita attractrice, ut mares et fœminas in animalbus, ſe invicem etiam e longinquo appetere cernimus, primum in ſtylum, in eoque per canaliculos ſibi proprios uſque ad ova delabatur ex hac autem farina plantæ ſuccis

enutrita,

Limits of human Apprehenſion, as indeed a great many other Subjects do, but even ſeems abſurd to Reaſon.

As therefore the Article of Generation has to this Time lain under inſuperable Difficulties, and as all the Methods of accounting for it, hitherto invented, have at laſt been found defective, why may we not ſuppoſe, that Nature herſelf points out the whole Proceſs of the Affair; eſpecially in forming the ſeminal Subſtance, diſtinct from the reſt of the Seed? namely, that the *Farina* is for this Purpoſe committed to the Air, that it may receive out of the Air this little Seed or Plant, præexiſtent and completely formed, tho' in *Stamina* inconceivably minute and inviſible; and thus become pregnant hereby? It is drawn by an inherent attractive Force (like as the Males and Females of Animals we ſee are mutually, and even at a Diſtance, affected) firſt into the Style, and thro' that it ſlides by proper Canals to the *Ova:* And from this *Farina,* nouriſhed by the

enutrita ad uſus, quorum ſupra meminimus; ſeminis confici molem in eo dein latitantem plantulam terrena jam materia ex farina indutam, ſe exſerere, et tandem alimentis e terra idoneis adauctam palam ſe efferre ſub auras.

Nec in hac ſtirpium generatione ſola fortaſſe hærendum eſt. Sed etiam ad omnium quæ in orbe noſtro vita donantur univerſitatem eaſdem cogitationes proferre æquum et rationi conſonum videri poſſit. "Omne "ſcilicet quod in hac tellure vitale eſt "(tum ſtirpes tum animalia) prius ſtaminibus "ſuis integre efformatum exiſtere, atque "ex aëre ſeu æthere deduci; et hic materia "terrena conveſtitum augeſcere et dilatari: "neque aliud eſſe generationem quam ſe"minis hujus mari ſeu maſculo immiſſi, et "in eo indolem terreſtrem, non ſine cœ"leſti aura, adſciſcentis et inducentis, in

Juices of the Plant for the Purpoſes above deſcribed, the Bulk of the Seed is formed. Laſtly, the little Plant hid in the Seed, and cloathed with a terreſtrial Matter, which it borrows from the *Farina*, exerts itſelf; and, increaſing by proper Nutriment, which it draws from the Earth, at length ſprings up.

Nor perhaps is this Method of accounting for Generation to be confin'd to Vegetables only; but it may, with equal Reaſon, be applied to the Production of every living Creature that makes a Part of this Univerſe of Things. "Whatever in this World have "Life (Plants as well as Animals) firſt of "all exiſt completely formed in Miniature, or in their firſt Rudiments, and are "taken from the Air or *Æther*; then, "being cloathed with an earthy Subſtance, "they increaſe and grow larger. Nor is "Generation any thing elſe than the placing "this Principle in the male Seed, where it "acquires an earthy Nature, tho' not without ſome Portion of an *Aura cœleſtis*, and "a proper Conveyance of it into a ſuitable

" uterum augendo illi idoneum, aptam commiſſionem." Ita cenſuit naturæ haud incelebris indagator * *Claudius Perraltius Gallus*; ita etiam nuperius præſtantiſſimus G. *Wollaſtonus* † noſtras, ut ſcriptis ſuis prodidit uterque.

Neque enimvero novum prorſus aut hujus ævi eſt hoc placitum; namque ſicuti *Pythagoras* cum ſequacibus ſuis, ſolem ſtare, terram in circuitum ferri (quod ab *Eois* didicerat ille) ſtatuebant, licet in calamitoſam rerum cœleſtium ſcientiæ perturbationem aliter ſenſerint poſteri; ita eximius inter ſui temporis ſophos *Anaxagoras*, uti de eo teſtatum reliquerunt *Romanorum* doctiſſimus *Varro* *, nec indoctior inter *Græcos Theophraſtus* †, ſemina ex aëre in terram prolabi docebat. Sic itidem ut profligata *Ariſtotelica*
et

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* *Traité des Animaux*, Part 3. Chap. derniere.

† Religion of Nature delineated, *Sect*. 5. *Subſect*. 15.

* Varro *de re ruſtica*, lib. 1. c. 40. " Primum ſemen, " quod eſt principium, id duplex; unum quod latet " noſtrum ſenſum; alterum quod apertum. Latet, ſi " ſunt ſemina in aëre, ut ait phyſicus *Anaxagoras*, etſi " aqua quæ influit in agrum inferre ſolet, ut ſcribit " *Theophraſtus*."

† Theoph. *Hiſt. Plant*. lib. 3. cap. 2. 'Αναξαγορας μὲν τὸν ἄερα πάντων φάσκων ἔχειν σπέρματα, καὶ ταῦτα συγκαταφερόμενα τῷ ὕδατι γεννᾷν τὰ ὄντα· *Idem de cauſis plant*. lib. 1. cap. 5. Εἰ δὲ δὴ καὶ ὁ ἄηρ σπέρματα δίδωσι συγκαταφέρων, ὥσπὲρ φήσιν Ἀναξαγόρας, &c.

" *Matrix*, where it may grow and increaſe." This was the Opinion of the ingenious *Claude Perrault* long ago, as well as of the celebrated *Wollaſton* our Countryman, as appears from the Writings of theſe great Men.

Nor is this Notion altogether new, or peculiar to the preſent Age. For, as *Pythagoras* and his Followers aſſerted, that the Sun ſtood ſtill, and the Earth moved, (as he had learned from the Eaſtern Philoſophers) tho' to the great Confuſion of Aſtronomy, ſome who came ~~after~~ after him thought otherwiſe: So *Anaxagoras*, who was juſtly eminent amongſt the Philoſophers of his Time, as the learned *Varro* and no leſs celebrated *Theophraſtus* inform us, taught, that the Seeds of all Things were in the Air, and deſcended from thence. Thus, in like manner as *Copernicus* reſtored the true Doctrine in relation to the heavenly Bodies, and baniſhed the Errors of *Ariſtotle*

et *Ptolemaica* de cœlis hæreſi invaluit antiqua et vera de iis opinio aſſerente eam *Copernico*, ita etiam hanc de generatione hypotheſin apud poſteros invalituram eſſe rem totam ſerio expendenti, dubitandi vix ſuperfore locum augurari licebit.

The END.

and *Ptolemy*, ſo there is juſt Room to apprehend that this Hypotheſis concerning Generation will be readily adopted by Poſterity.

FINIS.